

14 projects to fight rising seas get \$22m in grant from PUB

R&D funding will shape S'pore's capabilities in coastal protection, says Goh Hanyan

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Concrete waste is getting a new lease of life, as a local firm and Nanyang Technological University (NTU) are recycling it into carbon dioxide-storing concrete for sea-walls and other coastal protection measures.

A submerged breakwater covered with shells could also become a reality, with two research institutes at the National University of Singapore (NUS) and a consultancy firm developing the structure, which could weaken waves and serve as a new habitat for marine life.

These are two of 14 projects involving companies and academics that have received a total of \$22 million in a grant from national water agency PUB to develop innovative solutions for tackling rising seas and floods.

Announcing the grant recipients on Sept 18, Senior Parliamentary Secretary for Sustainability and the Environment Goh Hanyan said: "Our R&D investments will shape Singapore's technical capabilities in coastal protection, developing home-grown expertise within our industry and research community."

"This enables us to develop more innovative and cost-effective solutions that address our distinct coastal challenges... Singapore's urban space constraints and unique wave conditions mean we cannot simply adopt off-the-shelf solutions."

She was speaking at the Coastal Protection and Flood Resilience Institute's (CFI) symposium at NUS.

CFI and the new applied research projects are part of a growing pool of research efforts under PUB's \$125 million Coastal Protection and Flood Management Research Programme.

The project involving concrete waste is led by low-carbon concrete leader Pan-United. The waste is processed to become pebble-like aggregates, into which industrial carbon dioxide, or CO₂, is injected and converted into a mineral.

The CO₂ used is captured and liquefied from emissions by manufacturing, chemical and petroleum companies.

The resulting novel concrete is 15 per cent lighter than the ordinary kind.

"This tackles two problems at once, by upcycling waste and reducing carbon emissions," said Pan-United's chief executive Ken Loh.

"Due to their lightweight property, the aggregates can be used to make lighter but strong concrete for coastal structures, like sea-walls."

The lighter concrete could be a suitable material to top up existing coastal defences like shoreline slopes, raising the height without overloading the original structure.

Pan-United is currently working with NTU to develop prototypes of its novel concrete. The next step will be to embark on a field trial.

The 14 new projects were assessed based on how practical the solutions are in Singapore's context, and whether they have the potential to be monetised and installed along coastlines in the near term, said PUB.

The project on the submerged breakwater is led by the Technology Centre for Offshore and Marine, Singapore (TCOMS), which will work with Surbana Jurong and the NUS Tropical Marine Science Institute.

Instead of using boulders and concrete, the bund will be formed using soil and marine clay. The sea-facing side of the breakwater will be layered with discarded oyster or mussel shells.

"This shell-covered surface not only helps break waves, but also creates a textured habitat where marine life can settle and thrive," said Dr Lim Kian Yew, acting director of operations at TCOMS.

Over time, calmer waters behind the bund may encourage sediment to build up naturally, gradually raising the seabed as sea levels rise, he added.

Dr Lim added that the underwater breakwaters are suitable for coastlines with moderate waves, or near beaches where such hidden

structures will not mar the landscape.

This three-year project will involve engineering the shell-covered bund, running simulations, testing the structure in the field and studying whether tiny marine animals make homes in the shells.

In 2023, CFI was set up to bring together expertise from various universities to strengthen core research in areas such as coastal science, forecasting extreme weather and nature-based solutions.

There are 17 ongoing research projects, and the symposium gave updates on some of them.

A team led by Assistant Professor

Pearl Li Yuzhu from the College of Design and Engineering at NUS is building virtual models to help conservationists restore mangroves and seagrass meadows more optimally by understanding how sediments shape these habitats.

One model simulates how sediments move within complex root systems, using field data from Rhizophora mangroves in South-east Asia.

Early findings show that mangroves, especially saplings, are vulnerable to scour, when sediments erode and settle within mangrove roots.

"Commonly, people think mangroves attract sediments, but they can also be eroded by them. If the roots are not deep enough, the trees need to be protected," said Prof Li.



Senior Parliamentary Secretary for Sustainability and the Environment Goh Hanyan (centre, in blue) viewing a project by Coastal Protection and Flood Resilience Institute (CFI) at a symposium on Sept 18. CFI has trained more than 90 researchers and students to specialise in coastal protection and flood management through 17 projects. ST PHOTO: JASON QUAH

In another project, Professor Chu Jian from NTU's School of Civil and Environmental Engineering is creating tube-like barriers made of natural materials such as plant fibres and soya bean powder.

These barriers will shield beaches from strong waves. Over time, sand and soil can slowly accumu-

late and raise the shores, turning the beachfront into a natural "sea wall" of sorts.

Prof Chu is now working with Surbana Jurong and engineering firm HSL Constructor to test these barriers. They are looking at Tanah Merah beach – a sandy shore prone to erosion and strong currents –

and muddy shores near Yishun dam as possible test sites.

Fieldwork is expected to begin in early 2026. Over the first two years, beams of 100m in length and 50cm in height could line the coastlines of both sites.

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